Imaging the Aurora in the Far Ultraviolet

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The aurorae, seen from Earth as dancing curtains of green and red light concentrated in the polar regions, have captured the fancy of people throughout the ages. Scientists have known for several years that this light is a result of electrons and protons that are energized (accelerated) by the Earth's magnetic field and collide with the Earth's atmospheric constituents, namely atoms and molecules. How much energy is deposited in the auroral zones as a result of this process? How does the energy vary with changes in a solar-terrestrial environment? What was the origin of these energetic electrons and protons, and what was their path ending in collisions in the Earth's atmosphere? What is the source or impetus of the accelerating energy? What triggers a substorm, the sudden intensification of the aurora lasting for hours? These questions are significant to our understanding of the interplay between the Sun and the Earth.

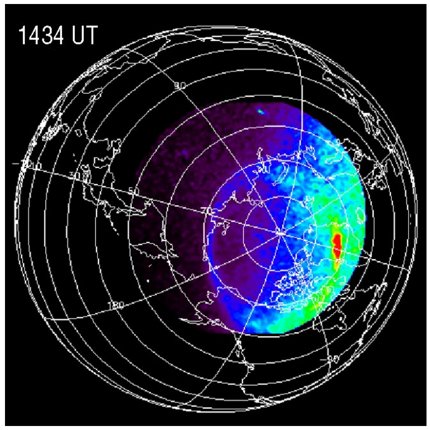

FIGURE 178.—This image was taken on April 9, 1996, at 14:34 UT. The sunlit portion of the Earth is on the right, over Greenland. In this image the night side aurora is calm as denoted by the thin blue feature.

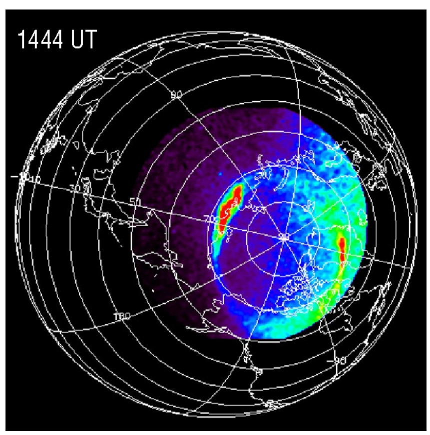

FIGURE 179.—This image was taken on April 9, 1996, at 14:44 UT, only 10 min after figure 178. In this image, the onset of a substorm can be seen on the night side over the coastline of Siberia.

The successful launch and activation of the ultraviolet imager (UVI) in February of 1996 will help scientists find answers to these questions. The UVI is a wide-angle camera that is sensitive in the nonvisible far-ultraviolet wavelength regime (130 to 190 nm). As such it images the light that results from precipitating energetic electrons both on the sunlit and night sides of the Earth. Images of the entire northern aurora, such as figures 178 and 179, are taken enabling the simultaneous correlation of different regions in the aurora with a time resolution of 37 sec. The special state-of-the art filters used in the UVI allow the imaging of different emissions in the far ultraviolet. This results in the ability to quantify the total energy and the characteristic energy of the electrons as a function of time and location on the globe. In concert with data from other instruments on several satellites and ground-based observatories, scientists around the world participating in the International Solar Terrestrial Physics Program (ISTP) will make use of the UVI images to study the source of the energetic electrons and phenomena that cause their energization.

Torr, M.R.; Torr, D.G.; Zukic, M.; Johnson, R.B.; Ajello, J.; Banks, P.; Clark, K.; Cole, K.; Keffer, C.; Parks, G.; Tsurutani, B.; and Spann, J.:"A Far Ultraviolet Imager for the International Solar Terrestrial Physics Mission." *Space Science Review*, vol. 71, pp. 329–383, 1995.

Sponsor: Office of Space Science

University Involvement: George Parks and Mitch Brittnacher at the University of Washington, Geophysics Program, Glynn Germany at the University of Alabama in Huntsville/Center for Space Plasma and Aeronomy Research.

Biographical Sketch: In 1984, Dr. James F. Spann Jr., received his Ph.D. in physics from the University of Arkansas. In 1986, he joined NASA/MSFC. During his career at NASA, Spann has been involved with the ultraviolet imager and is a co-investigator. Spann's research interests and experience include design and fabrication of space flight instruments, the interaction of single particles with light and plasmas, and the equilibrium phases atmospheric aerosols.